

### 3.8.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

**Radiation Environment.** Major sources and levels of background radiation exposure to individuals in the vicinity of RFETS are shown in Table 3.8.9–1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population changes as the population size changes. Background radiation doses are unrelated to RFETS operations.

**Table 3.8.9–1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Rocky Flats Environmental Technology Site Operation**

Source	Effective Dose Equivalent (mrem/yr)
<b>Natural Background Radiation<sup>a</sup></b>	
Cosmic and cosmogenic radiation	51
External terrestrial radiation	63
Internal terrestrial radiation	39
Radon in homes (inhaled)	200
<b>Other Background Radiation<sup>b</sup></b>	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
<b>Total</b>	<b>418</b>

<sup>a</sup> RFETS 1994a.

<sup>b</sup> NCRP 1987a.

Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from RFETS operations provide another source of radiation exposure to individuals in the vicinity of RFETS. Types and quantities of radionuclides released from RFETS operations in 1993 are listed in the *Site Environmental Report for 1993* (RFP-ENV-93). The doses to the public resulting from these releases are presented in Table 3.8.9–2. These doses fall within radiological limits (DOE Order 5400.5) and are small in comparison to background radiation. The doses given in the 1993 report were assumed to be representative of the reference environment (No Action) doses from RFETS operations in the year 2005 (Section 4.2.7.9).

Based on a risk estimator of 500 cancer deaths per 1 million person-rem to the public (Section M.2.1.2), the fatal cancer risk to the maximally exposed member of the public due to radiological releases and resulting impacts from RFETS operations in 1993 is estimated to be  $2.4 \times 10^{-7}$ . That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of RFETS operations is about 2 in 10 million. (Note that it takes several to many years from the time of exposure to radiation for a cancer to manifest itself.)

Based on the same risk estimator,  $5.0 \times 10^{-5}$  excess fatal cancers are projected in the population living within 80 km (50 mi) of RFETS from normal operations in 1993. To place this number into perspective, it can be compared with the number of fatal cancers expected in this population from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year (Almanac 1993a:839). Based on this national mortality rate, the number of fatal cancers from all causes expected during 1993 in the population living within 80 km (50 mi) of RFETS was 4,400. This number of expected fatal cancers is much higher than the estimated  $5 \times 10^{-5}$  fatal cancers that could result from RFETS operations in 1993.

**Table 3.8.9-2. Radiation Doses to the Public From Normal Rocky Flats Environmental Technology Site Operation in 1993 (Committed Effective Dose Equivalent)**

Members of the General Public	Atmospheric Releases		Liquid Releases		Total	
	Standard <sup>a</sup>	Actual	Standard <sup>a</sup>	Actual	Standard <sup>a</sup>	Actual
Maximally exposed individual (mrem)	10	0.13	4	0.35	100	0.48
Population within 80 km <sup>b</sup> (person-rem)	None	0.1	None	0 <sup>c</sup>	100	0.1
Average individual within 80 km <sup>d</sup> (mrem)	None	4.5x10 <sup>-5</sup>	None	0 <sup>c</sup>	None	4.5x10 <sup>-5</sup>

<sup>a</sup> The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10 mrem/yr limit from airborne emissions is required by the CAA, the 4 mrem/yr limit is required by the SDWA, and the total dose of 100 mrem/yr is the limit from all pathways combined. The 100 person-rem value for the population is given in proposed 10 CFR 834 (58 FR 16268). If the potential total dose exceeds this value, it is required that the contractor operating the facility notify DOE.

<sup>b</sup> In 1993, this population was approximately 2,200,000.

<sup>c</sup> Although the maximally exposed individual receives a dose, no population groups are exposed to any liquid pathways.

<sup>d</sup> Obtained by dividing the population dose by the number of people living within 80 km of the site.

Source: RFETS 1994a.

The RFETS workers receive the same dose as the general public from background radiation, but also receive an additional dose from working in the facilities. Table 3.8.9-3 presents the average worker, maximally exposed worker, and cumulative worker dose to RFETS workers from operations in 1992. These doses fall within radiological regulatory limits (10 CFR 835). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers (Section M.2.1.2), the number of fatal cancers to RFETS workers from normal operations in 1992 is estimated to be 0.32.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the *Site Environmental Report for 1993* (RFP-ENV-93). The concentrations of radioactivity in various environmental media (including air, water, and soil) in the site region (onsite and offsite) are also presented in this reference.

**Chemical Environment.** The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface waters during swimming and soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in Section 3.8.3.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (for example, air emissions and NPDES permit requirements), contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at RFETS via inhalation of air containing hazardous chemicals released to the atmosphere by RFETS operations. Risks to public health from other possible pathways, such as ingestion of contaminated drinking water or direct exposure, are low relative to the inhalation pathway.

**Table 3.8.9–3. Radiation Doses to Workers From Normal Rocky Flats Environmental Technology Site Operation in 1992 (Committed Effective Dose Equivalent)**

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard <sup>a</sup>	Actual
Average worker (mrem)	ALARA	122
Maximally exposed worker (mrem)	5,000	>10,000 <sup>b</sup>
Total workers <sup>c</sup> (person-rem)	ALARA	800

<sup>a</sup> DOE's goal is to maintain radiological exposures as low as reasonably achievable.

<sup>b</sup> Three workers received doses that exceeded the standard. Only one worker received a dose greater than 10,000 mrem.

<sup>c</sup> The number of badged workers in 1992 was approximately 6,550.

Source: 10 CFR 835, DOE 1993n:7.

Baseline air emission concentrations for hazardous chemicals and their applicable standards are included in the data presented in Section 3.8.3. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are in compliance with applicable guidelines and regulations. Information about estimating health impacts from hazardous chemicals is presented in Section M.3.

Exposure pathways to RFETS workers during normal operations may include inhaling the workplace atmosphere and direct contact with hazardous materials associated with work assignments. The potential for health impacts varies from facility to facility and from worker to worker, and available information is not sufficient to allow a detailed estimation and summation of these impacts. However, the workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. RFETS workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals utilized in the operational processes, ensures that these standards are not exceeded. Additionally, DOE requirements (DOE O 440.1) ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm. Therefore, worker health conditions at RFETS are expected to be substantially better than required by the standards.

**Health Effects Studies.** Several epidemiologic studies have been conducted on communities surrounding RFETS. The studies of surrounding populations have found no substantiated evidence of increased risk of cancers related directly to RFETS. Mixed findings have been reported from studies of workers, with some studies reporting increases in risk of some cancers, others finding no associations, and one reporting a significant deficit in numbers of lung cancers. For a more detailed description of the study findings reviewed, refer to Section M.4.8.

**Accident History.** A review of recent RFETS annual environmental and accident reports indicates that there have been no radiological or chemical releases that resulted in impacts to workers, members of the public, or the environment. The review was performed to support the affected environment presentation in the *Nonnuclear Consolidation Environmental Assessment* published in June 1993 (DOE/EA-0792).

**Emergency Preparedness.** Each DOE site has established an emergency management program that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

The RFETS has comprehensive emergency plans that provide guidance and procedures that are designed to protect life and property within the facility, the health and welfare of surrounding metropolitan communities, and the defense interests of the nation during any credible emergency situation. Mutual assistance and coordination with Federal, State, and local agencies is ensured on a cooperative basis.

The DOE Rocky Flats Area Office Manager coordinates activities for emergencies affecting offsite personnel or property and is responsible for communication with the supporting Federal, State, and local agencies. The DOE Rocky Flats Area Office Manager may obtain further assistance through the Interagency Radiological Assistance Plan, which provides that each of the signatory Federal agencies will assist one another in the event of a major emergency involving radioactivity.

The Rocky Flats Emergency Plan expresses the philosophy that RFETS be as self-sufficient as possible in handling onsite emergency situations. Assistance may be requested from outside sources through written agreements with St. Anthony Hospital, St. Luke's Hospital, University of Colorado, Jefferson County Sheriff's Office, and the Federal Bureau of Investigation.

In the event of an offsite emergency, the *Rocky Flats Radiological Assistance Plan* interfaces with the *DOE Radiological Assistance Plan*, the *Interagency Radiological Assistance Plan*, and the Joint Nuclear Accident Coordinating Center through the DOE Rocky Flats Area Office at Rocky Flats. Also, in the event of an incident at RFETS involving the release of radioactive material that may endanger the health and safety of the general public, the *Colorado Radiological Emergency Response Plan* would be activated.